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ABSTRACT

A questionnaire examining consumer needs, spending, travel, credit options and utilization practices in adaptive/assistive and educational technology was answered by 2,201 Arkansans with disabilities of all ages. This paper focuses on data on respondents with speech impairments, although most respondents reported multiple handicaps. While most respondents expressed satisfaction with the technologies they were using, widespread difficulties were reported in travel (22% reported having to travel over 100 miles to receive their technology) and availability of credit plan options. Includes 53 references. (PB)

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**Ultimate Functioning of Persons with Speech Problems: Technology Use
Patterns and Needs**

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Running Head: TECHNOLOGY USE PATTERNS AND NEEDS

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Ultimate Functioning of Persons with Speech Problems: Technology Use Patterns and Needs

It is well-recognized that speech, language, and/or communication difficulties are associated with most handicapping conditions (McCormick & Haring, 1986). Among persons with learning disabilities and mental retardation, for example, language and communication problems are prominent (Berdine, 1985; Morsink, 1985). Similarly, many severely handicapped persons have difficulty with speech and language because the requirements of language and communication are demanding in both cognitive and motoric respects. There is also a large group of persons in our society who have only a speech problem not associated with some other type of difficulty (McCormick, 1986).

Certainly no one can argue that there has been an exponential proliferation in the development of assistive technologies designed to assist persons with speech problems. Since the first report of an electronic communication device over three decades ago (Lavoy, 1957), a vast array of communications systems have been developed (McCormick & Haring, 1986; Vanderheiden, 1977; Vanderheiden & Yoder, 1986). With the availability of relatively inexpensive, lightweight, battery-operated computers, such devices are becoming as practical and manageable as hearing aids and eyeglasses (McCormick & Haring, 1986). But technologies are also rapidly evolving and being disseminated in other areas as well for persons with disabilities. For example, instructional methodologies are available which can be used to shape and increase the rate of vocational production (Bellamy, Peterson, & Close, 1975; Gold, 1976; Wehman & Hill, 1985). Applied researchers have documented nonpunitive educative procedures to decrease aggressive and self-abusive behavior patterns (Horner & Bud, 1983; Whitman, Sciback, & Reid, 1983; Whitman, Hurley, Johnson, & Christian, 1978). Adaptive technologies are even available that enable persons with severe disabilities to control their living environments via personal computer systems and robotics (Behrmann & Lahm, 1984; Brown, Cavalier, & Tipton, 1986), attain independent mobility via electric wheelchairs (Stout, 1979), drive automobiles (Less, Coverd, Demauro, & Young, 1978; Shipp & Havard, 1989), participate in sexual relationships (Mooney, Cole, & Chilgren, 1979), and communicate their thoughts using only a single voluntary

movement (Brown, 1989; Vanderheiden, 1978).

As assistive technology in the area of augmentative communication has changed and become more readily available coupled with the escalating use of technologies in other areas, there has been a corresponding shift in the awareness of the public regarding the *general* use of technology by all persons with disabilities. This is suggestive that the goal of ultimate functioning in our society is receiving particular attention by professionals and service providers who work with technology, as well as consumers of technology themselves. As Brown, Nietupski, and Hamre-Nietupski (1977) so aptly described this ideal goal:

The criterion of ultimate functioning refers to the ever changing, expanding, localized and personalized cluster of factors that each person must possess to function as productively and independently as possible in socially, vocationally, and domestically integrated adult community environments. (p. 8)

Based on this criterion, we would no longer evaluate educational, therapeutic, or rehabilitation programs on the numbers (rather than importance) of the skills learned by persons with speech problems, the amount of direct therapy time available, or the staff-to-individual ratio provided. Instead, we would begin to reference our technology service progress to the technology requirements of the integrated environments found within our communities where persons with speech problems reside. Because of the significance of this concept to meaningful technology service provision, we are challenged to look at each of its components in greater detail.

In the first section of the criterion of ultimate functioning, "the localized, and personalized cluster of factors that each person must possess" is important in that skills required for full participation in community life vary markedly. These skills change over time and are particularly influenced by local conditions and factors, varying across cities and people relative to any particular person's age. Transportation, for example, is one area in which technology skills change across environments. In a large metropolitan area, the use of public transportation and related technologies would be crucial for any person; in a remote rural area, such transportation probably would not be available dictating the need for technology-related skills in using individual transportation modalities, such as walking or using some type of vehicle. In either case, communications skills are important as well as other skills which either directly or indirectly

involve the use of existing technologies.

Within the definition wherein it states "in order to function as productively and independently as possible" it is apparent that the emphasis is upon the person and his/her ultimate functioning. Key words here are *as possible* since this assumes that all persons will vary in their levels of achievement across skill areas, which, in this case is level of production and independence. All persons, particularly those with speech problems, can attain some degree of productivity and independence, especially when appropriate technologies are provided.

Finally, the criterion of ultimate functioning makes reference to "integrated adult community environments". This assumes that persons with disabilities be accepted by, have interactions with, and equal access to the same places that nondisabled persons have in our society. Such environments include grocery stores, restaurants, shopping malls, public transportation, and homes in the community.

The reality of ultimate functioning for persons with speech problems, and all other persons with disabilities, may come into fruition with the passage of P. L. 100-407, the *Technology-Related Assistance for Persons with Disabilities Act of 1988*. Monumental in its conception, the legislation was enacted with a dual purpose: (a) to provide grants to states on a competitive basis to establish comprehensive, consumer-driven systems of technology assistance to persons of all ages having disabilities, and (b) to provide technical assistance to those states receiving funding under the legislation, as well as to those states attempting to secure funding. Inherent in P.L. 100-407 was a generalized recognition that there are substantial numbers of persons having disabilities in the United States who have significant limitations in their ability to perform one or more important life functions, often resulting in disabilities and handicaps (Office of Technology Assessment, 1982). Whether disabilities such as speech problems become handicaps depends upon the interaction of the person with the disability with the physical and social environments in which that person comes in contact, especially technologies that are available in those environments (Blackstone, 1986).

The present study was designed to examine the technology use patterns and needs of a limited sample of persons having speech problems in Arkansas. Data generated for the study was a subset of information gathered as part of an extensive consumer survey of persons having

disabilities of all types as a component of a grant application in response to P. L. 100-407. Though obvious limitations to generalization of the findings of this study are apparent, the implications for technology planning designed to facilitate ultimate functioning among persons with speech problems have utility for practitioners who are involved in technology service provision.

Method

Subjects. Mailing lists of persons with disabilities were obtained from 9 public and private agencies providing services to persons with disabilities in Arkansas. Approximately 12,000 mailing labels were submitted for use in the study, constituting a sample of a wide range of consumers representing many disability categories. In order to address the elderly population of the state--a significant component of the Arkansas population base (Division of Demographic Research, 1988)--contact was made with publication headquarters for *Arkansas Aging*, a periodical of the Department of Human Services, Division of Aging and Adult Services and the Arkansas Association of Area Agencies on Aging, and consent was obtained to reproduce the Consumer Survey instrument in its newspaper. This publication has a circulation of approximately 35,000 within the State of Arkansas. Consent was also obtained to reproduce the Consumer Survey in *ARC news*, a monthly newsletter disseminated by the Association for Retarded Citizens/Arkansas which has a circulation of approximately 4,000. These periodicals, as well as the mailing lists provided by the 9 participating agencies and organizations, reflected the potential to reach approximately 52,000 Arkansans.

Return envelopes were included in the mailout of 12,000 survey instruments though no return envelopes were included in the published versions of the survey in the aforementioned newsletters. It was recognized from the outset that this strategy would significantly affect return rates from the readership of these newsletters, yet project budgetary constraints prohibited the use of return envelopes with such a volume of mailouts. Surveys were mailed during the first week of April of 1989. A poor response rate from the elderly consumer audience having access to the survey form published in *Aging Arkansas* was indicated following the initial mailout. To insure that the elderly sector of the state was adequately represented in the survey, a second mailout of 1,200 instruments using return envelopes and which were mailed to six Area Agencies on Aging was conducted in June of 1989.

Instrument. A four-page questionnaire was designed to examine consumer needs in a variety of areas pertaining to technology, as well as to investigate technology utilization practices. Areas specifically covered by the questionnaire included items focusing on use and needs for technology in 16 areas of life functioning, spending practices for technology, funding support systems, travel practices, need for information, credit options for technology purchases, and satisfaction items related to technology services and devices.

Inter-data entry reliability. Data from returns were entered on computer by four project staff personnel. All records were entered on a PANORAMA (ProVUE Development Corporation, 1988) database. This computer program provided a screen simulation of each survey instrument that was visible to data entry personnel. Data entry reliability was determined by examining a random sample of 10% of the returned consumer and professional survey forms and comparing actual data entered on computer to that exhibited on the survey forms. Since data were entered in a visible screen section, or window, relating to the actual survey instrument, an error rate ranging from only 0 to 5% for various items occurred. Most errors occurred on items requiring the data entry staff to interpret open-ended or fill-in-the-blank responses, *e.g.*, name and address.

Results

Demographics. A total of 2201 consumer survey forms were received, reflecting a return rate of approximately 20% of the survey forms which were mailed that included return envelopes. Surveys which were disseminated via the mechanism of *Aging Arkansas* and *ARC News* were not included in data analysis due to the poor response rate that resulted perhaps due to not using return envelopes. Only 28 responses were obtained using these two periodicals as vehicles for survey dissemination. Of this respondent pool, 698 surveys were received from persons having speech problems, or 32% of the total.

Self-reports of related disabilities exhibited by participants in the survey having speech problems included the following: learning problems (66%); mental retardation (59%); physical handicaps (50%); visual impairments (48%); hearing impairments (27%); emotional problems (16%); breathing problems (12%); heart problems (11%); head injuries (9%); and other disabilities (15%). Distribution of participants by age group was as follows: <3 years (6%); 3-21 years

(38%); 22-59 years (41%); ≥ 60 years (7%); unreported (8%).

Areas of technology usage and unmet needs. Technology usage was reported in all areas of life functioning by the consumer respondents with speech problems participating in the survey. As noted in Table 1, the areas in which technology was most often used by 50% or more of the respondents was *getting around*, followed by *self-help*, *recreation*, *specialized seating*, *things that help you see*, *school training*, and *hearing aids and other devices*. Unmet needs were also reported in all areas of life functioning. In 9 of the 16 areas of life functioning, consumers reported unmet needs more often than usage.

Insert Table 1 about here

Levels of satisfaction. Table 2 reports levels of satisfaction experienced by consumer survey respondents with speech problems. A majority of respondents reported that they participated in an assessment or evaluation prior to obtaining their assistive devices/services, though a relatively small proportion reported not having had an assessment or evaluation. Similarly, a comparable percentage of respondents reported that they were satisfied with the services they received for their assistive devices. With regard to the need for more information pertaining to assistive devices/services, a large number of the respondents indicated such a need. This need for information was supported by the high percentage of unmet needs reported in all categories of assistive devices/services (see Table 1).

Insert Table 2 about here

In the area of purchasing practices, it is noted in Table 2 that only about 1/5 of the respondents expressed having had the opportunity to purchase assistive devices on a "buy-on-time", or credit plan, and more than half reported that such a plan would be helpful to assist them in purchasing needed assistive devices. Almost 1/3 of the respondents reported that they did not receive adequate training in the use of their devices, and more than 1/2 reported that they did not have an opportunity to try out devices before being required to pay for them. Most respondents voiced satisfaction with the length of time required for the servicing of their devices when they were in need of repair. Interestingly, for those respondents who appeared to be

employed ($n = 304$), almost 1/3 of the respondent class indicated that *no* attempt to change the work environment was made.

Expenditures for assistive technology. Consumers with speech problems were asked to report their expenditures for assistive devices, services, and/or maintenance during 1988 (see Figure 1). One-third of the respondents reported expending less than \$100 for technology devices and services. Expenditures of more than \$100 were reported by relatively small percentages of the respondents. Almost 1/3 of the consumer respondents reported lack of knowledge of expenditures for assistive technology in 1988.

Insert Figure 1 about here

Funding sources. Funding sources for assistive devices/services which were reported for those respondents participating in the survey included a wide range of mechanisms, though several funding sources appeared to predominate usage by consumers with speech problems. The largest funding sources for assistive devices/services reported for the total respondent class were Medicare/Medicaid (50%), the consumer and/or their family (31%), and insurance companies (14%). Public school expenditures for assistive devices were reported by only 5% of the respondents.

Travel practices. In the area of travel practices reported by consumers with speech problems, about 1/5 of the respondents reported that no travel was involved in order to receive the assistive devices/services which they were using (see Figure 2). Almost 1/3 of the respondents reported traveling 1-20 miles to receive their assistive devices/services, while a small group of consumers reported they had to travel 21-50 miles to receive such services. More than 1/3 of the respondents reported having to travel over 50 miles to receive their assistive devices/services. Respondents were also asked to indicate whether or not transportation services were being provided to them. Of the 606 persons responding to this item, 51% reported not being provided with such services.

Insert Figure 2 about here

Discussion

Technology is providing persons having speech problems with important tools that ultimately can optimize their interactions with the world about them. However, for this particular sample of persons with speech problems, the promise of technology falls far short of the ideals of optimum functioning which are so often delineated in the professional literature (Blackstone, 1986; Vanderheiden & Dolan, 1985) given the large proportion of persons who evidence needs for technology. In examining the areas of assistive devices/services used and areas of unmet needs reported by survey respondents (see Table 1), more than 1/3 of those responding indicated needs in 15 of the 16 areas of life functioning. Similarly, in 10 of the 16 areas, 50% or more of the respondents reported unmet needs. This seems, at least on the surface, to be quite significant from both a planning and service delivery perspective.

By design, the survey instrument that was used in this study lacked specificity regarding types of technologies used by persons having speech problems. However, it was reported that over half of the respondents had unmet needs in the area of *talking with others*. Recent advances in the field of augmentative communication indicate that the total communication needs of persons with disabilities is being increasingly focused upon in the profession (Vanderheiden & Yoder, 1986). The advent of high technology, and particularly the microprocessor, is facilitating intervention in numerous areas including (a) quick phrases, expletives, and interjections; (b) messages; (c) interactional conversation; (d) written communication; and (e) access to and use of computers and information systems which exist in the environment (Vanderheiden & Yoder, 1986). Persons with speech problems who have more advanced skills can be provided with technologies which address each of these areas of communication. Examples of text-to-speech technologies which have been developed clearly indicate that both voice and intelligibility facets of these communications systems are evolving rapidly (Romich & Kushler, 1988). Also, display technologies enable the representation of specialized symbol systems (Steele, Weinrich, Kleczewska, Carlson, & Hennies, 1988). These and other advancements reflect that the promise of technology to enhance the skill development and communication of persons with disabilities is very real, yet these advancements are far from being widely used in our society.

The large percentage of persons with speech problems who reported unmet needs in the area of computer technology is of particular concern. An earlier report has suggested that by

1990, 75% of all jobs in the U.S. will require the use of a computer terminal (Scadden, 1983). The implications of this statistic from a vocational perspective are clear, in that persons with disabilities will increasingly be challenged to develop computer competencies that enable them to effectively compete in the labor market with their nondisabled peers. Even at the other end of the age continuum, the development and utilization of computer skills is drawing growing attention from professionals in light of the implications for optimum interactions with the environment. It has been shown, for example, that microcomputers can be successfully applied to infants in facilitating the development of cause-effect relationships (Behrmann, 1984) and to enable severely handicapped infants in making simple requests (Meyers, 1984). Such findings will very likely result in greater usage of computers at the lower age ranges as P.L. 99-457, the *Education of the Handicapped Amendments of 1986*, becomes fully implemented in the public school systems across the country. Even now, public schools are just beginning to utilize imaginative computer technologies for teaching traditional subjects which motivate both teachers and students to attempt new ways of information gathering and learning (Office of Technology Assessment, 1988). A type of software which holds great promise for the future is simulation software (Cain & Taber, 1987), or learning by doing through decision making. Situations which are similar to real life circumstances and present general guidelines to the solution of a problem are inherent in such software applications. Such systems enable persons to apply previously mastered knowledge or values to new learning situations that engender real life predicaments or environments. Using this software, the consequences of decisions made are immediate, yet given the simulation nature of the software, no personal risk is involved. With regard to persons who have speech problems, simulation software could easily be adapted for on-the-job situations involving fellow employees such that communication strategies could be practiced. Since probable consequences could readily be programmed into these software programs, alternative solutions could be attempted, explored, and analyzed, providing valuable instruction in the affective domain for the persons with the speech problem, thereby maximizing their effective interactions with the environment through the use of this technology.

Another exciting application which has been developed is the Multisensory Authoring Language System (MACS) developed by the Johns Hopkins University (Schiffman & Tobin,

1987). Generally, authoring language systems are software tools which allow instructors to design individual computer learning experiences for students without having to learn particular programming languages. MACS is a special type of authoring program which permits the use of sound, voice, graphics, and print to interact with the program, enabling the creation of individualized electronic lessons rather than forcing students to adapt to a predetermined courseware [the case with most commercially available computer assisted instruction (CAI) packages].

Closely associated with the expressed need for computers in the lives of the persons having speech problems is the reported need for assistive devices and services in reading, writing, and typing. For almost 30 years computers have been employed to provide instruction or drill and practice in basic skill areas such as reading and writing (Office of Technology Assessment, 1988). As an example of the effectiveness of this application in public school settings, computer-assisted instruction (CAI) has been frequently shown to be an effective supplement to traditional classroom instruction (Cain & Taber, 1987; Lally, 1981; McCormick & Haring, 1986) (see Table 1).

Even in the area of telephone usage, which was the third greatest area in which unmet needs were reported by persons with speech problems, emerging technologies are readily apparent which can optimize the control people exercise over their own lives (Lauer, 1989). New ways of managing information are increasingly being incorporated into existing service delivery systems such as the Bell Telephone system. Gateway services offered through the Bell system hold particular promise. One prototype of this system currently exists in Houston, Texas. Using the Voice Gateway, a customer can dial and receive a variety of recorded messages and simple instructions to access a wide range of information. In using the Data Gateway, a customer sees listings for information and entertainment options on a simple video terminal or personal computer screen. The possibilities of such telephone technologies are limitless, with options for offerings pertaining to shopping, travel, special community events, health care, photography, sporting events, dining, and other community activities being available to telephone consumers. Such services have already been offered to the general population in Europe, but implementation of a wide range of similar services is now possible in the U.S. in the near future (Lauer, 1989).

One area which appeared to be of particular concern in the study was the lack of

transportation services which was being provided to respondents. Of the pool of participants who responded to being asked whether transportation services were being provided to them ($n = 606$), more than half (51%) reported lack of receipt of such services. Transportation recognizably is a vital component of any technology service delivery system (DeLoach & Greer, 1981; Dunham, 1978). To receive appropriate education, medical care, vocational training, employment, and other types of needed services, persons with speech problems, as with other persons who are nondisabled, must leave their residences and travel to the sources of these services. Typically, mass transportation systems are generally available only to persons residing in more urbanized areas. Unfortunately, these systems have yet to incorporate into their designs modern technologies which enable full access to the systems by persons having disabilities, due in large part to persistently negative attitudes towards such persons as well as lack of awareness regarding available technologies and cost factors relevant to them (Parette & VanBiervliet, in press).

It is also striking that more than 25% of the respondents reported travel between 21 and 100 miles to receive their technology (see Figure 2), while 22% reported travel in excess of 100 miles. Since a majority of the participants with speech problems had indicated that transportation services were not being provided to them, it can be inferred that these persons are providing their own transportation within the service delivery system. Alternatively, some persons might be accessing transportation modalities provided through P.L. 88-365, the *Urban Mass Transportation Act of 1964*, and did not perceive this mechanism as a transportation service.

Despite this lack of transportation, respondents voiced satisfaction with the technologies which they were currently using (see Table 2). Only about 1/5 of those participating in the study reported lack of satisfaction. However, it should be observed that dissatisfaction with existing services was expressed by 1/3 or more of the respondents in a number of areas, including receipt of training in the use of their assistive technology, length of time to repair technology, and need for more information regarding available technology. In each of these cases, transportation to the sources of specific technology needs might very well result in greater levels of satisfaction with technology services and more optimal levels of interaction with communities being realized for persons with speech problems.

More than 3/4 of those participating in the study also reported not having had the

opportunity to purchase needed technologies on some type of credit plan. Of this group, 42% of persons with speech problems indicated that were such a plan available it would have been helpful in securing needed technology. Credit-based funding systems have repeatedly been suggested to be important components of technology service delivery systems (Mendelsohn, 1989; Office of Technology Assessment, 1982). At both the private sector and nonprofit agency level, alternatives are being developed nationwide to assist persons with disabilities to secure technologies without initial full payment. Examples are observable at the state level in the direct loan model created under the New York State Equipment Loan fund for the Disabled and in California's Handicapped Transportation and Supported Employment Loan Guarantee Programs (Mendelsohn, 1989). Since most consumers who are nondisabled have the opportunity to purchase goods in our country using credit based plans, it seems only reasonable that such plans should be afforded to persons with speech problems to assist them in securing technologies which facilitate more optimum functioning and participation in our society.

Admittedly, there are obvious limitations to the generalizability of the findings of this study to other populations. Only a small sample of persons with disabilities was surveyed from across Arkansas, and this sample was determined by mailing lists submitted by agencies providing services to these individuals. Though the data suggest that many types of disability categories were included in the sample, it is obvious that most respondents had more than one type of disability. Only 13 of the total respondents reported having *only* a speech problem, suggesting that the needs and practices of this sample, constituted primarily of persons with multiple disabilities, might be very different from persons having only a disability in the area of speech.

Despite these limitations, it is important that such examinations of the technology needs and practices of persons with speech problems be undertaken by states seeking funding consideration under P.L. 100-407. Data such as these prove to be invaluable when designing comprehensive state plans of technology-related assistance for persons with speech problems, as well as other types of disabilities (see *e.g.*, RESNA, 1989). As such comprehensive systems come increasingly into fruition nationwide, it is anticipated that the goal of ultimate functioning in social, vocational, and domestic domains for all persons in our society will become more a reality as opposed to an ideal.

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Table 1
Areas of Assistive Devices/Services Used and Areas of Unmet
Needs as Reported by Consumer Survey Respondents
with Speech Impairments

Area	<i>n</i> of Use	% *	<i>n</i> of Unmet Need	% *
Getting Around	226	.73	83	.27
Self-Help	236	.65	130	.35
Recreation	199	.58	145	.42
Specialized Seating	116	.56	91	.44
Things That Help You See	120	.56	93	.44
School Training	158	.52	148	.48
Hearing Aids & Other Hearing Devices	102	.50	102	.50
Artificial Limbs, Braces, & Prostheses	79	.49	83	.51
Taking Care of Home	119	.48	129	.52
Work & Work Training	114	.46	132	.54
Talking with Others	149	.44	190	.56
Specialized Cars, Vans, & Buses	116	.44	146	.56
Building Accessibility	114	.43	154	.57
Using a Telephone	111	.42	154	.58
Reading, Writing, & Typing	115	.41	169	.59
Using a Computer	62	.25	188	.75

* Indicates percentage of respondent class

Table 2
Reports of Satisfaction with Technology Services
Provided to Consumer Survey Respondents
with Speech Impairments

Question	<i>n</i> Yes	%*	<i>n</i> No	%*
Were you given an evaluation before getting your assistive device?	438	.84	85	.16
Are you satisfied with the services you receive for assistive devices you use?	399	.80	98	.20
Have you received enough training in the use and care of your assistive device?	272	.68	128	.32
Do you need more information about assistive devices/services that could help you?	395	.67	191	.33
Are you satisfied with the time it takes to repair/service your device?	210	.63	126	.37
Were you able to try out the device before paying for it?	169	.45	203	.55
Did you have the opportunity to buy assistive devices/services on a "buy-on-time", or credit plan?	86	.21	327	.79
If not, would a "buy-on-time", or credit plan help?	205	.58	149	.42
If employed, did your employer change your work area or equipment to meet your needs?	36	.12*	91	.30**

* Percentage of respondent class

** Percentages computed on number of respondents reporting yes/no as well as respondents reporting "no changes needed" (*n*=304)

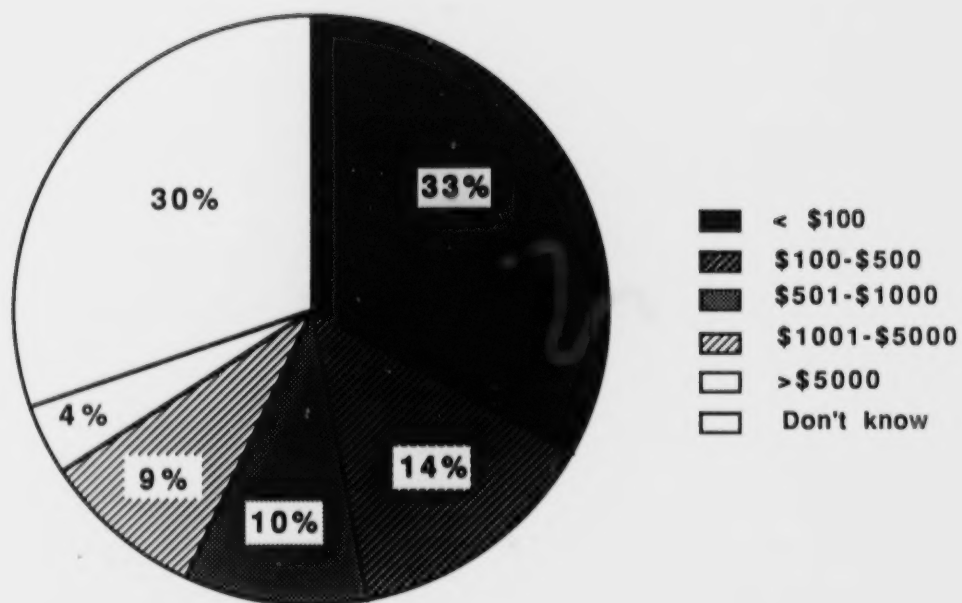


Figure 1. Reported expenditures by persons with speech problems for assistive technology in 1988.

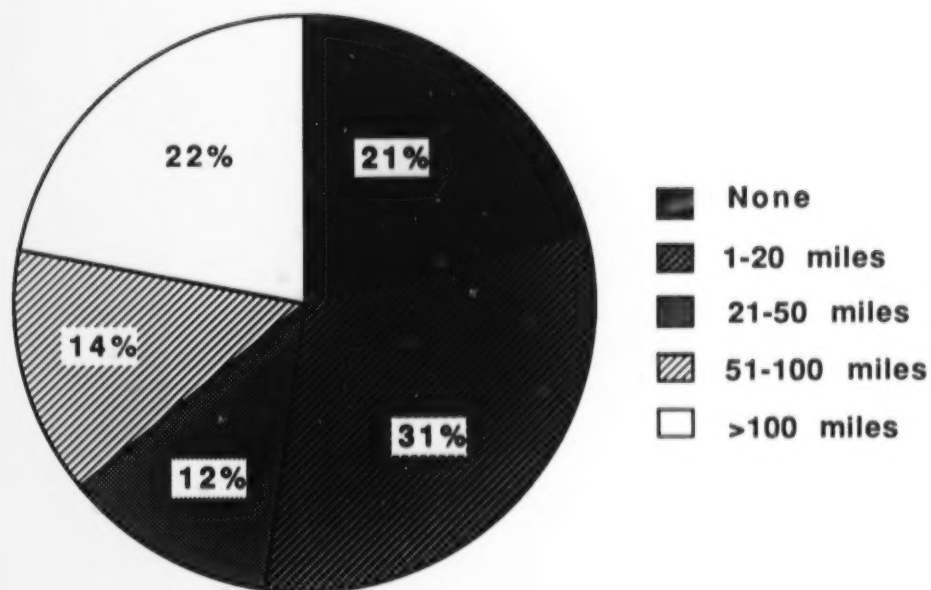


Figure 2. Reported travel by persons with speech problems to receive assistive technology in 1988.